

PERSPECTIVES

Decoupling in Science and Education:

A Collateral Damage beyond Deteriorating U.S.–China Relations

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Abstract: Deteriorating relations between the United States and China since 2018 have extended to education and scientific research arenas. We put the U.S.–China science and education in a historical perspective and describe the win-win situation when both countries collaborated. We discuss an ongoing loss-loss scenario of the decoupling and speculate its far-reaching adverse impacts beyond the two countries. We call for actions to be taken for a brighter future by the leaderships in both countries.

Keywords: decoupling; U.S.-China Relations; science diplomacy

Introduction

The world's two largest scientific communities are now witnessing unprecedented yet escalating tensions ever since the Cold War. Since 2018, dozens of prominent scientists in the United States, most of Chinese origin, have been fired or investigated for undisclosed ties with China.^[1] These, combined with continuing shuttering of Confucius Institutes on U.S. university campuses, strict limits on Chinese nationals studying or conducting research in science, technology, engineering, and mathematics (STEM) fields, revocations of visas for Chinese scholars who are already studying in the U.S., the closures of Chinese Consulate in Houston and the U.S. Consulate in Chengdu in succession, and the recent “Strategic Competition Act of 2021”, are casting long shadows on the U.S.–China scientific relationship.

U.S.–China relationship in science and education

A historical perspective

In spite of ups and downs of the bilateral relations, science and education had played a largely positive role bridging the two nations. In 1854, Yung Wing became the first Chinese to be awarded a bachelor's degree from Yale University. In 1872, under his suggestion and supervision, the first batch of Chinese teenage boys was sent to the United States, shouldering the hope of absorbing Western academic ideas and making China civilized and prosperous.

Funded by the Boxer Indemnity Scholarship and other programs in the early 20th century, top Chinese returnees from America staffed Chinese universities, contributing to the institutionalization of higher education and scientific research in China. Historically, of the 23 scientists who were responsible for developing China's strategic weapons programs, 19 had foreign study and/or work experience, including 10 in the U.S.^[2]

Since China and the U.S. established formal diplomatic relationship in 1979, an increasing number of China's best and brightest minds traveled west to study advanced science and technology. Today the U.S. has remained the most favorable destination for Chinese students to pursue their studies. According to the most recent IIE data, in the 2018/19 academic year, some 370,000 Chinese students attended American universities, on top of which, 48,000 Chinese scholars were conducting research in the U.S., with Chinese, accounting for about one third of the international students and scholars in the U.S. and surpassing those from any other foreign countries.^[3] As of early 2020, the total number of Chinese at foreign countries as international students reached 1.6 million with at least a quarter in the U.S.^[4] Conversely, with the rapid development of the Chinese economy, more American students and scholars travel eastward, temporarily or permanently, to undertake research in Chinese universities. As reported by the Ministry of Education of China, more than 492,000 international students and scholars studied in China in 2018, of which 20,996 were from the United States.

The present situation

All these were in jeopardy under the Trump Administration. The U.S.–China trade war, soon after it started in 2018, has spread to technology and talent areas (Figure 1 chronologizes the major events of U.S.–China relations since 2018). Consequently, the barriers for Chinese students and academics to study and work in the U.S. had become more tacit and politicized. China's proactive efforts of attracting

talent through high-end talent recruitment programs had seen the pushback from the U.S. government under Trump, which initiated the investigations into the involvement of America-based scientists in such programs. American politicians also have called for banning Chinese students from studying STEM subjects at American universities. In a word, the U.S. seeks to decouple with China in not only trade but also technologies and talents. American people also have turned negative toward the presence of Chinese, but not necessarily international, students on American university campuses.

The U.S. shifting view of China from an “economic and strategic rivalry” to a “foreign adversary” signaled its rising concerns over issues from China’s access to core technologies such as chips, alleged inappropriate use of intellectual property rights through forced technology transfer and technology theft and espionage, to national security at the front of 5G technology and cyber security.^[5] Ultimately the difficult technological relationship between the two countries boils down to intellectual exchange and scientific collaboration. There have been no signs of a quick reversal of the relationship after the change of the leadership in the US in January 2021.

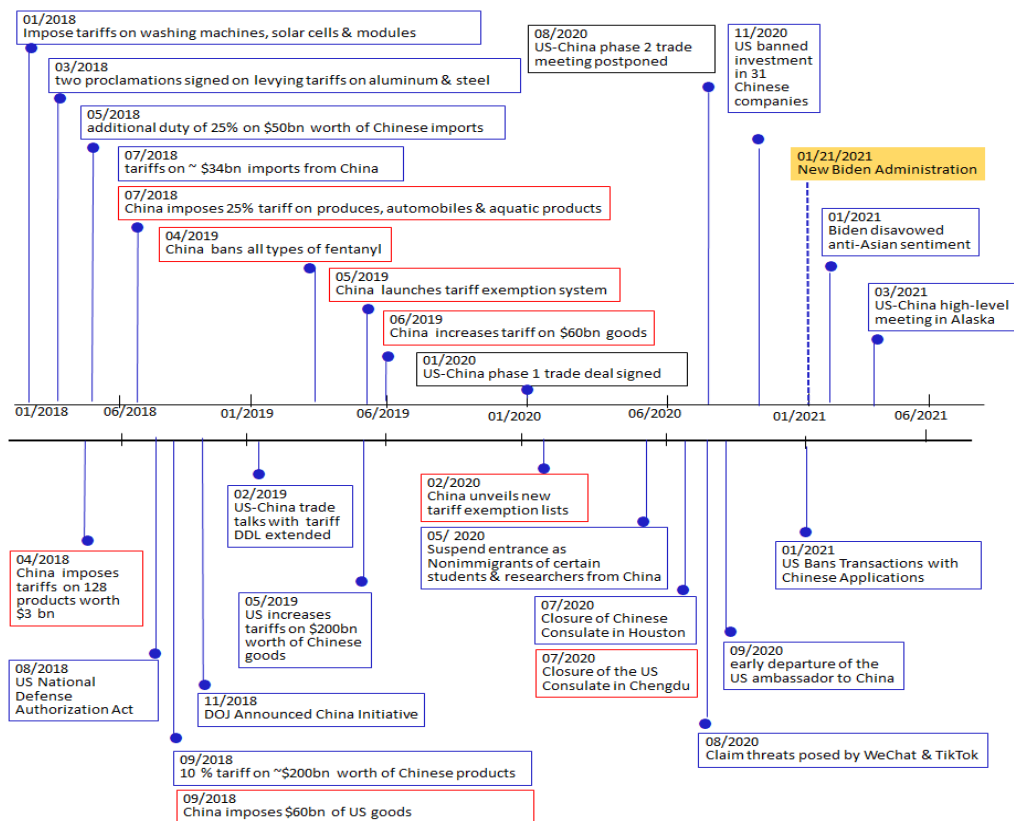


Fig 1. A chronology of major events of U.S.–China relations (Jan. 2018–Mar. 2021)

Impacts on the two countries and beyond

Win-win in the past

Despite the current frictions, there was a long cozy period of U.S.–China collaboration that brought a win-win situation of knowledge creation, sharing, diffusion, and innovation on both sides. Studies show that the foreign-born and educated have contributed disproportionately to the advancement of U.S. innovation and science supremacy.^[6] From 2003 to 2017, as the largest source country of U.S. science and engineering (S&E) doctorates, over 80% of the Chinese recipients remain in the U.S. workforce and continue their contribution to American economy five years after receiving their doctorate degree.^[3] In 2018 over one quarter of U.S. internationally collaborated S&E articles had contributors from China.^[3]

On the Chinese side, in addition to its remarkable decades-long economic development, rapid accumulation of human capital, and technocratic policy push, China’s rise in science owns a great degree to international academic exchange and ensuing collaboration with advanced economies, especially with the U.S. Our analysis reveals that joint publications between the U.S. and China jumped from only 57 articles in 1980 to 51,583 in 2019 with an annual growth rate of 20% over 40 years.

Combined, journal articles involving Chinese or American scholars make up 47.4% of the global knowledge production indexed in the Science Citation Index database.¹ Chinese knowledge moderators with training in developed countries, including the U.S., had contributed tremendously to China's rise in science and technology.^[7] Within the unbalanced collaboration network, learning-by-collaborating elevated China's status in vital scientific and technological fields with surprising rapidity.^{[8][9]}

America also benefits greatly from educating and collaborating with international students, scholars and entrepreneurs. Looking back into history, the scientific, technological and economical supremacy of the U.S. has been deeply rooted in its capacity of tapping into the pool of global talents via the conduits of foreign-born scientists and New Argonauts.^[10] In particular, over the last decades, the U.S. has been able to retain a significant amount of U.S.-trained talent, especially those at the high-end measured by the possession of an American PhD degree. More than 80% of the Chinese with an American PhD managed to stay in the U.S. five years after receiving the degree.^[4] In some cutting-edge fields such as artificial intelligence, the top Chinese-origin minds are conducting world-class research in the U.S.^[11] Such collaborations between the two countries play a significant part in pushing forward the frontiers of knowledge for the entire world.

The ongoing loss-loss scenario

While it will be years before we know the full effect of the current U.S.–China tensions on scientific exchange and innovation network between the two countries, such effect could be felt in various aspects.

The impacts on China are significant. On one hand, China may benefit from the push from the U.S. side leading to an increasing and accelerating return of the Chinese academics and other professionals from the US. As talent is always scarce in number and unbalanced in terms of training, utilization, and distribution, both pull and push factors could change the redistribution of talent on a global scale.^[12] While a significant number of Chinese-origin students and scholars, especially those with U.S. research degrees, tend to seek local employment and permanent residency after graduation, recent decade has also witnessed an increasing number of students and scholars returning to China upon finishing their stints in the U.S. owing to opportunities provided by China's faster economic growth, increasing attention paid to R&D and higher education, and government and universities' preferable policy towards returnees.

On the other hand, in addition to the overwhelming amount of high-end talent still residing in the U.S., the turning away of Chinese students and scholars by leading American universities and high-tech enterprises may mean a gradual cutoff of China from the world's leading edge in science and technology. Together, they may slow down China's ambition to become an innovation-driven nation and a world's scientific superpower, which may ultimately reconstruct global value chain and geopolitical order unfavorable to China's modernizations.^{[13][14]}

Decoupling China in science and education could be detrimental to the U.S. as well. The U.S. has been dependent upon the mobility of talent from countries such as China to sustain the development of its scientific and educational enterprise. The loss of international students first means financial hardship for some American universities, many of which are heavily funded by the tuition paid by international students. The sheer scale of Chinese students and scholars contributed about \$14 billion to the U.S. economy and created 153,000 local jobs in the U.S. during the 2018/19 academic year.^[16] The amount of money is non-trivial, especially amid the Covid-19 pandemic which already has put tremendous pressures on American universities and the U.S. society.

The chilling U.S.–China relations, could also cause innovation deficiency which is looming at many institutions where there has been significant dependency on international graduate students and academics, particularly those from China. Partly fueled by the timing of a series of criminal investigations on scientists with Chinese background or links as well as accounts on tightened visa rules against Chinese applicants, many American universities, despite being politically neutral and providing continued support to Chinese students and scholars, are not short of anecdotal evidence suggesting that political hostility has been felt by the community of Chinese students and academics at various levels. This increasingly unwelcoming atmosphere felt by these Chinese could push them away from American universities, R&D institutions, and high-tech enterprises.

¹ Authors' own calculation. Data are available upon request.

Decoupling in science and education is also eroding trust and respect from the people on one side, scientific communities included, toward the other side of government. The unfriendly political environment and great uncertainties in bilateral relationship are enticing unfavorable public opinion toward each other. The more severely the collateral bias, suspicion and even hostility between two nations require years to amend, or even reach a point of no return.

The decoupling may not be justified

Studies have proposed a myriad of speculations for Sino-U.S. potential confrontations and decoupling in science and education, ranging from national security concerns, economic and technological competitiveness, global leadership.^{[5][14][16]} Amid the complex and multifaceted reasons is the U.S. adamant belief that China has been reaping more through research collaboration and globalization on an unfair ground. In fact, the U.S. concerns over China's enhanced research capabilities are not new. Over the last two decades, the consensus achieved among the upper echelons of the United States has been that American global leadership in science and technology is declining vis-a-vis Asian nations—especially China. China's global talents recruitment plan and Made in China 2025 Strategy further solidified the stereotype of China as a nation posing unprecedented challenges to American technological leadership and global supremacy.

Be that as it may, the decoupling is still not justified. As noted in *The Art of War* by Sun Tzu, killing one-thousand enemies is often at the cost of own eight hundred soldiers wounded. Confrontations could not resolve international disputes, at least not in the most rational and effective way.

Far-reaching impacts beyond bilateral relations

The weight of the U.S. and China in the global economy and scientific research means the deteriorating relationship between them is a global issue. It not only hurts the two countries but also wounds the rest of the world.

The ongoing more comprehensive technology decoupling between the U.S. and China would wreak havoc on the commercial and scientific bonds between the two countries that had thickened over some four decades and may end up with having two distinct digital and technology jurisdictions. For example, the Internet might be turned into “splinternets” and there might be two 5G networks. This would have significant and more likely adverse implications for both China and the U.S. and the rest of the world in technology and innovation and beyond. Therefore, there is urgency to reduce the scope and scale of the conflicts and instead further expand cooperation in scientific research and education between the two countries and other countries. This is not just for the benefit of a specific country, such as China's economic development and technological upgrading, but a shared development of humankind with the power of science and technology.

Global production of knowledge is becoming the norm in many scientific areas. The long-term ripple effect of the decoupling can also damage the collaboration in the international research community, especially in meeting the global challenges in areas from public health, food security, climate change, energy, to sustainable development, whose adverse effects could be felt globally. The lack of effective cooperation between the two major participants could significantly delay the advancement of many of the above global projects and eventually cause harms to all nations. The outcome could be even worse if other countries are forced to choose sides between the two powers for research partnership.

Most importantly, we should not let the parochial mentality of national competitiveness blind all nations' shared vision of sustainable development as a human community. We should encourage competition but should not turn the competition into a zero-sum game, engineered by science, technology and international collaboration.

Look forward into the future

More than a century ago, in conveying his vision to build strong ties with China through education, University of Illinois President Edmund James wrote: “China is upon the verge of a revolution [...] The nation which succeeds in educating the young Chinese of the present generation will be the nation which for a given expenditure of effort will reap the largest possible returns in moral, intellectual and commercial influence.” One century since, the Center for Science Diplomacy of AAAS explicitly states on its website, “[...] science can build bridges between societies where official relationships may be strained.”

No bilateral disputes can be resolved without both sides meeting halfway. Preventing further worsening of the U.S.-China relationship calls for the political wisdom of the leaders who take actions to re-couple education and science as a way of seeking common ground while reserving differences. Rebuilding mutual trust and respect is the key paving the way for a turning point of the U.S.-China relationship.

On the U.S. side, the Biden Administration needs to take immediate steps to prevent any possible and unintended disruption to the country's scientific research and higher education due to actions aimed to cut off China from its research network with America. On the Chinese side, efforts need to be made in protecting intellectual property rights. To give its credit, China amended the Patent Law and issued a new Foreign Investment Law in 2020. For the former, the amendment, the fourth time, aims, among others, to strengthen the protection of intellectual properties by increasing statutory damages, introducing punitive damages, and shifting the burden of proving damages in patent infringement actions. And the latter law gets more serious about protecting investor's rights, including their IPs. More can be done in terms of credible commitment and consistent law enforcement. China may also need to contemplate both domestic and international concerns over a *de facto* decoupling in the Internet by lifting the restriction placed on the access to Google, Dropbox, and many other Internet sites for academic use. At this critical moment, natural and social scientists in both countries need to be more proactive in promoting research collaboration and fostering bilateral relationship. Global issues ranging from the ongoing pandemic and future health crises, global warming, environmental degradation, terrorism, and governance of dual-use emerging technologies such as artificial intelligence and synthetic biology, all call for scientific collaboration and governmental cooperation of the two scientific and economic powers and other nations.

As the issue of education is that of future generations, youngsters in the U.S. and China and indeed worldwide should join forces and contribute to creating a more livable human community by nurturing an atmosphere of encouraging cooperation without discrimination and by sharing knowledge and cultures without prejudice.

References

- [1] Mervis J (2020) Fifty-four scientists have lost their jobs as a result of NIH probe into foreign ties. *Science*, June 12.
- [2] Simon DF, Cao C (2009) *China's Emerging Technological Edge: Assessing the Role of High-end Talent*. Cambridge: Cambridge University Press.
- [3] Institute for International Education (2020). Open Doors Database. Available at <https://www.iie.org/Research-and-Insights/Open-Doors>
- [4] National Science Board, National Science Foundation (2020) Science and Engineering Indicators 2020: The State of U.S. Science and Engineering. Alexandria, VA.
- [5] Schneider-Petsinger M, Wang J, Jie Y, Crabtree J (2019) *US-China Strategic Competition: The Quest for Global Technological Leadership*. London: Chatham House.
- [6] van Holm, E., Wu, Y., Welch, E. (2019) Comparing the collaboration networks and productivity of China-born and US-born academic scientists. *Science and Public Policy*, 46(2), 310–320.
- [7] Tang, L. (2013). Does "Birds of a Feather Flock Together" Matter: Evidence from a Longitudinal Study on the US-China Scientific Collaboration. *Journal of Informetrics*, 7(2), 330-344.
- [8] Leung, R. C. (2013) Networks as sponges: International collaboration for developing nanomedicine in China. *Research Policy* 42(1), 211-219.
- [9] Freeman, R.(2014) Immigration, International Collaboration, and Innovation: Science and Technology Policy in the Global Economy. NBER Paper w20521, DOI 10.3386/w20521
- [10] Saxenian, A. (2007). *The New Argonauts: Regional Advantage in a Global Economy*. Harvard University Press. ISBN 9780674025660
- [11] Mozur P, Metz C. (2020). A U.S. Secret Weapon in A.I.: Chinese Talent. *The New York Times*, June 9.
- [12] Bansak C, Simpson NB, Zavadny M (2015) *The Economics of Immigration*. London: Routledge.
- [13] Lee, J.D., Lee, K., Meissner, D., Radosevic, S. Vonortas, N.S. (2020) Local capacity, innovative entrepreneurial places and global connections: an overview. *The Journal of Technology Transfer*, <https://doi.org/10.1007/s10961-020-09812-7>
- [14] Wyne, A. (2020) How to Think about Potentially Decoupling from China. *The Washington Quarterly*, 43(1). 41-64.

- [15] NAFSA (2020) *Losing Talent 2020: An Economic and Foreign Policy Risk America Can't Ignore*. Washington, DC: NAFSA.
- [16] Sekiyama, T. (2019) An Outlook for the US-China Trade War. *Security Studies*, 1(1), 38-49.